

Eco-friendly technology for Textile Industry

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Abstract: The international green tribunals are coming up stricter norms which lead to a higher challenge for a processor and its material suppliers. ZDHC, GOTS, OEKO TEX, FLO are some of the initiatives taken worldwide which is not only helping to protect environment and health and softy issue but also helping processors for ways and means to achieve green process, saving carbon footprints and reducing the banned chemicals in textiles process chain.

The textile industry is ecologically harmful industry in the world. Textile industry releases harmful pollutants in large quantities which causes air pollution and water pollution. It also spreads harmful diseases and health issues in people getting exposed to the pollutants. Global warming is a direct result of the pollutants released by such industries. Contamination of the air, water and land by textile industries and its raw material manufacturing units has become a serious threat to the environment.

Some of the retailers and brands in western countries have taken a green initiative to produce goods in most sustainable manner. On the contrary, there is very little awareness amongst Indian manufacturers and end consumer about the harmful impact on the environment. Some of the processing units are still discharging untreated effluents which are polluting water bodies, some of the dyes and chemicals can even cause chronic diseases. So it is very important to bring about awareness amongst textiles manufactures and end users. Technology is a key to reach sustainability targets of the Textile Industry.

This study focuses on remarkable innovations in technology which have paved the way for sustainable production technologies like eco-friendly fibres, innovations of eco fabric, eco friendly development in processing.

But there is huge scope further for all technology providers to upgrade technology which will help in economical production of the goods in sustainable manner.

Keywords: Eco-friendly, textile technology, sustainable

Date of Submission: 26-02-2020

Date of Acceptance: 09-03-2020

I. INTRODUCTION:

The consumption of natural resources has been increased exponentially in past decades in rapidly industrializing countries & it is relatively recently that we have started recognizing the unpleasant consequences of the carefree attitude towards the natural environment. Textile industry is condemned of being one of the most polluting industries in the world. In turn, these processes generate air, water & soil pollution through untreated effluent generation & waste generation which place heavy burden on environment. More than 2000 types of dyes, chemicals & other auxiliaries are being used in Textile Industry. The World Bank estimates that almost 20% of global industrial water pollution comes from the treatment and dyeing of textiles.

Today, the growing awareness of environmental issues makes customers to select eco friendly products over conventional products. While the end-consumers of textiles were earlier concerned with only the finished product, there has been an increasing drive to better understand the input materials, the relevant production processes and their implications on the environment, be it air, water or soil. It has become imperative that Textile Industry should address such issues within our supply chain & adopt better and cleaner technologies.

New green technologies help industries to achieve green production and cost reduction at the same time. Therefore there is an urgent need to promote new green technologies in textile processes.

- **Objectives of the study:**

- 1) To make aware people about Ecofriendly fibers and fabrics.
- 2) To get acquainted with the sustainable techniques or methods to upcoming entrepreneurs.

- **Environment-friendly Techniques or Methods:**

The use of organic raw material can help in fighting the emission of pollutants by the textile units. Besides, the waste generated from textile manufacturing plants should be processed in a manner that it is

free from toxic chemicals before it is disposed. Environment friendly techniques can be applied at fiber, yarn and fabric stage.

- **Following new innovation in Eco-friendly Fibres are pollution free and maintain the balance of eco-system :**

i) **Bamboo:** Bamboo is regenerated cellulosic fibre produced from bamboo pulp. **Bamboo fibre** can be used to make exceptional modern textiles. Our clothing, such as our bamboo socks, is made from 100% bamboo fibre and the fabric is also used in bed linen, duvet covers towels and much more. Bamboo can also be blended with cotton, hemp or even Lycra as required.

ii) **Corn fibre:** Corn is available in both spun and filament forms. It balance strength and resilience with comfort, softness and drape in textiles. Corn also uses no chemical additives or surface treatments and is naturally flame retardant. Corn fibre manufacturers have claimed that these fibres can be used for sportswear, jacket, outer coat, apparels, etc.

iii) **Banana fibre:** It is also known as musa fibre which is one of the strongest natural fibres. Organic banana fibre is used to make various eco-papers like tissue, filters and currency paper. Being natural, heat resistant, having good spinning ability and high tensile strength, it is used for making yarn, fabrics and garments. It can be blended with other fibres and can be used to make Silk grade Saris.

iv) **Milk fibre:** It is the new innovative fibre and a kind of synthetic fibre made of milk casein fibre through bio-engineering method. It can also used to create top-grade underwear, shirts, t-shirts, loungewear, etc. It contains 17 amino acids and natural anti- bacterial rate is above 80%. Hence milk fibre has sanitarian.

v) **Alovera fiber:** Aloe vera contains 75 potentially active constituents. It is sugar-free, rich in fibre and made from the natural and pure Aloe Vera leaves. The main advantage of Aloe Vera Microfiber fabric is a finishing touches of Aloe Vera, it's concentration in the fabric is very nourishing for the body, mainly for human skin. The fabric is produced by innovative technology and is made of polyester microfibers.¹³

- **Recent innovations of eco fabrics which are safeguard to environment :**

Even though many fabrics are available in the market, we can bring new innovations in the field of eco textiles which protect our environment from further depletion. So go green and make fashion more eco friendly.

1) **Samatoa/ lotus fabric:** fabric extracted from lotus flower is known as Samatoa. Lotus plant is believed to have healing abilities. Lotus plants are pure by virtue and they radiate this purity through their fibres. By wearing lotus fibre fabrics, the wearer feels calm, peaceful and meditative. It also cures headaches, heart ailments, asthma and lung issues.¹⁶

2) **Fabrics from fermented wine:** A group of scientist at the University of Western Australia has produced fabric by letting microbes to work on wine. It is produced by adding bacteria called acetobacter into cheap red wine. The bacteria ferment the alcohol into fibres that float just above the surface.

3) **Cocona fabrics:** Cocona is a fabric that is developed from fibrous coconut husks that incorporates natural ingredients into polymers. Cocona fibres and yarns can be used in a wide range of knit and woven fabrics as well as non-woven that provide effective evaporative cooling, odour adsorption and UV protection. This is lightweight, comfortable and retain all of the conventional product features, such as stretch and wash ability.

4) **Jute fabric:** Jute textile is a low cost eco friendly product and has superior drapability and moisture retention capacity . It is widely being used as a natural choice for plant mulching and rural road pavement construction. Use of biodegradable and low priced jute products is increasing day by day. It cab be blended with other fibers to make fabrics.

5) **Ayurveda:** Ayurveda is a branch of ayurveda that means ayur as "health" and vastra as a "cloth". Ayur vastra cloth is completely free from synthetic chemicals and toxic substances making this cloth organic, sustainable and bio-degradable. Ayur vastra is made up of 100% pure organic cotton or silk, wool, jute and coir products that have been hand loomed, dyed by using various ayurveda herbs and have medicinal qualities. Herbs used in ayur vastra are known to cure allergies having anti-microbial, anti-inflammatory properties. Ayur vastra is extra smooth and good for transpiration that helps in recovering various diseases.¹⁴

- **Innovations of Ecofriendly Technologies in Textile Industry :**

Textile industry is a voracious consumer of water. The water is used for various processes like sizing, scouring, bleaching, dyeing, printing and other finishing processes. In addition to this, the waste water is full of a variety of dyes and chemical additions that add to the challenge that they pose for the environment. This challenge is not only as a waste, but also as chemical composition. Many biological treatment methods are available to remove organic pollutants and make the treated water safe for disposal.

⇒ **Electrochemical Processing :**

The textile industry uses the electrochemical techniques both in textile processes (such as decolorizing fabrics and dyeing processes) and also in wastewaters treatments (color removal from waste water).

Electrochemical reduction reactions are mostly used in sulphur and vat dyeing, but in some cases, they are applied to effluents discoloration. These electro generated species are able to bleach indigo-dyed denim fabrics and to degrade dyes in wastewater in order to achieve the effluent color removal.⁴

• **Bleaching of Textile Material:**

Cotton bleaching takes place after the scouring process with the aim of destroying the natural raw color of this fiber. The most common reactive to provide whiteness to cotton is hydrogen peroxide.⁴ Chong and chu proposed the use of the electrolysis process in a combined scouring and bleaching process, and they concluded that the whiteness obtained in the combined method is comparable to that obtained with conventional methods¹.

• **Dyeing Process:**

Vat dyes, especially indigo, play an important role in textile industry.⁹ They are insoluble in water and cannot dye fibers directly. Sulphur dyes also are water-insoluble dyes. The most attractive new procedures to reduce vat and sulphur dyes are electrochemical reduction method which avoids the generation of toxic products due to the reaction between the added reagents and the dye molecules.¹¹

• **Wastewater Colour Removal:**

The textile industry produces large volumes of wastewater in its dyeing and finishing processes. The electrochemical methods are nowadays the subject of a wide range of investigations at laboratory and pilot-plant scale.⁵ The advantage of these electrochemical techniques is that electron is a clean reagent. They also have good versatility and high-energy efficiency. They are easy for automation and safety because it is possible to operate at smooth conditions.¹²

⇒ **Electro coagulation Method** provides electrochemical aggregation of heavy metals, organic and inorganic pollutants, to produce a coagulated residue to be separated or removed from water. In this method, use of electro-oxidation is carried out with active chlorine, which is the major oxidizing agent. In this case, free-chlorine gaseous and/or the generated chlorine-oxygen species such as hypochlorous acid (hclo) or hypochlorite ions (clo-) depending on the pH, oxidize the organic matter present in the effluents.⁶

⇒ **Indirect Oxidation Methods**, when strong oxidants are generated in situ during the electrolysis and react with the organic pollutants such as dyestuffs, producing its total or partial degradation.⁷ This is the electro-Fenton process, where organics degradation occurs by hydroxyl radicals (OH•) formed from Fenton's reaction between catalytic Fe^{2+} and H_2O_2 , this hydrogen peroxide is also electro generated from O_2 reduction.¹⁰

⇒ **Dyeing Without Water**

Air Dye technology manages the application of color to textiles without the use of water. Depending on the fabric, and type of dyeing, Air Dye uses up to 95% less water, and up to 86% less energy, contributing 84% less to global warming, according to an independent assessment requested by the company. Air Dyed fabrics do not leach colors or fade as easily as vat dyed fabrics, because the dye is actually inside the fibers². This technology works only on synthetic materials and is currently available only in the United States.

• **Color Removal from Textile and other Industrial Wastewater using Ozone:**

Ozone has been used for successfully for removal of color from textile wastewater streams in plants around the world as well as in other industrial wastewater processes. Ozone is effective in removing the color from all dyes used in textile processing. In wastewater treatment, ozone is often used in conjunction with biological treatment systems such as activated sludge. In addition, ozone treatment of wastewater increases the oxygen content of the water which results in improvement in aerobic processes.⁸

• **Application of nano technology in textiles**-Nano finishes has size in the range of 1 to 100 nm, act as catalysts that help break down carbon-based molecules, and require only sunlight to trigger the reaction & being developed for textile substrates are at their infantile stage. However, the new concepts exploited for the development of nano finishes have opened up exciting opportunities for further R&D.¹⁵

• **Use of enzyme in textile processing for green technology**-Advances in enzymology, molecular biology and screening techniques provide possibilities for the development of new enzyme-based processes for a more environmentally friendly approach in the textile industry. Unfortunately most of enzymes are not

certified from various environmental & safety communities only because these are genetically modified otherwise these are non polluting processes.

- **Fabric from recycled polyester**-Polyester textile recycling has been developed using the clear plastic water bottles, or PET as the raw material, a source of plastic that would otherwise go into landfill.

II. CONCLUSION

If we see awareness on the hazardous effluent generated & amount of energy consumed during the entire manufacturing process of textiles & apparels amongst the end-consumers, it is very limited. Many of them are not even aware that some of the dyes & chemicals used are carcinogenic and life threatening. There is very little awareness amongst Indian manufacturers & end consumer about the harmful impact on the environment. It is very important to bring about awareness amongst textile manufacturers & end-users. Entire textile value chain should take the initiative to manufacture the goods economically with sustainable processes & technologies with minimum or no impact on environment or consumer. Technology is a key to reach sustainability targets of the Textile industry.

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Kavita Patil. "Eco-friendly technology for Textile Industry." *IOSR Journal of Humanities and Social Science (IOSR-JHSS)*, 25(3), 2020, pp. 26-29.